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Address by

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I am very grateful for the opportunity to address this group this evening. It is a particular pleasure to meet with you in a state that has contributed so much to the national space effort, for no area of the country has contributed more to this nation's space programs than the state of Texas.

This evening, I want to talk with you about the progress, prospects and future of NASA's Manned Space Flight programs, which constitute the largest and most complex scientific, engineering and technological undertaking in the history of the Free World.

First, however, I would like to discuss with you some of the aspects of these programs which are of particular significance to the future of our society. The implications, consequences and effects of recent advances in scientific and technological development are immense. These advances are not confined to space alone, but involve almost every known science and technology -- physics, chemistry, electronics, biology, astronomy, geology, geodesy and cartography, heat studies, cryogenics, particles and fields, to name but a few. (Parenthetically, I might add that the space program, in its breadth, spreads across this entire scientific and technological spectrum.)

Indeed, today, few dispute that we stand at the

threshold of a new era. The Industrial Revolution has been the dominant economic and social force in the world for about 200 years, since the advent of Watt's steam engine. It is now being challenged by another force, one which has been characterized by Dr. Glenn Seaborg as the Third Revolution - the Knowledge Revolution.

In this era of unprecedented change, new knowledge is a kingdom whose great wealth cannot be estimated, and a vital natural resource that can never be exhausted. Our reservoir of knowledge has thus become much more than a mere instrument for perpetuating our culture. It has come to be a prime index of our greatness, functioning not only as a source of our strength, but as a measure of our fitness to survive and grow as a nation. For today, knowledge, as much as guns and butter, measures the true power of modern states.

In the very forefront of this 'Knowledge Explosion,' which is so radically changing our whole way of life here on earth, has been man's exploration into space.

This new and dynamic force is a powerful creator of knowledge in many very tangible ways. The most obvious way is in the exploration of space itself. Here in the pursuit of knowledge, man is learning more

about the universe in which he lives. The rapid increases in scientific and technical knowledge gained by our space explorations are opening up old boundaries and creating vast new fields of understanding for man, in addition to the effects this increase in knowledge is having on our life here on earth. Couple the achievements in space technology with the great accumulation of new knowledge in space related science, and we have the ingredients for the profound impact of the space enterprise on our future patterns of living.

Man's accomplishments in space have unlocked the human imagination; they have increased man's spirit of adventure and pioneering; and they have presented him with the greatest challenge of all time - the breaking away from the confines of his local planet.

For a million and a half years there have been man-like creatures on this planet. And during all of these eons man has been confined to the thin membrane of his earth's atmosphere. Now, in just the past five years, man has broken these confines.

For some, however, the meaning of this achievement is seen only dimly and superficially. The purposes of space exploration and discovery are no clearer to many men in this age than they were in the days of Galileo.

It does take a great deal of vision to see beyond the initial difficulties of opening a new frontier. No one would pretend to foresee all the changes that will follow in the wake of our explorations and discoveries in space. When he first set foot in the New World, Columbus surely could not have envisioned the America of the Twentieth Century -a land of oil and steel and factories and wheat fields and skyscrapers and 200 million people.

In like manner, it is not possible to evaluate the ultimate results of our exploration into the new environment of space. However, countless examples from history show that it does pay, often in the most unexpected ways, for man to satisfy his natural curiosity. There is absolutely no doubt in my mind that a dynamic space program will ultimately bring rewards in knowledge, wonders, and resources far surpassing the investment it requires in money, materials, and brainpower. Indeed the steps that we have taken to date have already moved us to new thresholds in many arenas.

Thus, while none of us can foresee <u>all</u> of the ramifications of this new enterprise upon our life and society, of one thing we can be certain. The exploration of space will have a profound effect upon how we look at our life here on earth. Indeed, the shape of what is within our reach through space exploration and

technology is fantastic beyond all ordinary understanding.

From the foregoing, it is clear that the character of the Space Age is far from simple. It is a composite of many elements which are very closely inter-related. To begin with, it is important to understand that space science and exploration are not remote and esoteric pursuits, but rather, are deeply woven into the fabric of our society. The space scientist does not practice a new art. He is a physicist, a chemist, a geologist, an astronomer, an engineer, a doctor, a biologist, an educator, a nuclear and radiological expert, a business-man and much more - deeply rooted in the vigorous effort to expand our knowledge of the universe in which we live and of which we are a part.

It has been noted that space is actually a technological tapestry upon which we may embroider the outline of a new dimension of social, economic, cultural, and hopefully, political progress. In this perspective, space exploration can indeed be one of the bases upon which we will build the future technological structure required to support a progressive, evolutionary society.

Before we take a look into the future, however, let us pause and examine where we are today in space. The past year and a half has been a period of particularly significant achievement in our Manned

Space Flight Programs - Gemini and Apollo. In Gemini, seven successful flights have been conducted since January of last year. Six of them were manned. Twelve U. S. astronauts have logged more than 1300 man hours in space, and traveled some eleven million miles - almost 50 times the distance from the Earth to the Moon. On one flight alone, Frank Borman and Jim Lovell flew the equivalent distance of more than 10 1/2 trips to the moon and back.

We have conducted the first extravehicular activity using a self-propulsion unit (Ed White's "Walk in Space"). We have demonstrated precision spacecraft maneuvering, culminating in the first rendezvous and docking in space, and in controlled spacecraft re-entries. And we have performed many significant scientific, technological and medical experiments. All of these operations are essential to the Apollo lunar mission and to other space operations of the future. We expect to accomplish all of the remaining objectives of the Gemini Program in the four remaining flights.

Although the Gemini 9 mission had to be postponed from its original launch date last week, we expect to complete most of the major mission objectives in the rescheduled Gemini 9A mission, scheduled for next

Tuesday, May 31. This will be a three-day flight to explore new rendezvous and docking techniques and to conduct further extra-vehicular activity. In lieu of the Agena Target Vehicle, which was lost last week when its Atlas booster failed, we will use an Augmented Target Docking Adapter. Since this Docking Adapter does not have a propulsion system, it will not be possible to conduct post-docking maneuvers except with the spacecraft thrusters. However, the Docking Adapter does have a complete rendezvous and docking capability, which should make it possible to conduct all of the rendezvous and docking exercises essentially as planned for the original Gemini 9 flight, as well as the extended extra-vehicular activities.

Excellent progress is also being made in the Apollo Program, in which we are working to establish clear United States pre-eminence in space. The work to bring this about is focused on the mission objective of Apollo, the landing of men on the moon and their safe return, before the end of this decade.

The first major flight mission in the Apollo Program was successfully carried out on February 26. This key milestone, an unmanned flight test of the three-man Apollo spacecraft and the Saturn IB launch vehicle, leads the way to manned Apollo flights in earth orbit,

which are scheduled for 1967. Work is also progressing toward the flight tests of a much larger space vehicle, the Apollo-Saturn V, which will make the actual lunar flights. The first unmanned flight of this vehicle is scheduled for 1967, with manned flights in 1968, and the first manned lunar mission planned for 1969.

A major milestone in this program was successfully accomplished last Wednesday, May 25, when a prototype of the Apollo-Saturn V space vehicle was moved by the "Crawler-Transporter" from the Vehicle Assembly Building at NASA's Kennedy Space Center to Launch Pad, a distance of about 3 1/2 miles. This "roll-out," I might note, involved the world's largest space vehicle, mounted on the world's largest land vehicle, and moved from the world's largest building to the world's largest launch pad.

SHOW FILM: Manned Space Flight - 1966.

This is a crucial year for the Apollo Program. However, I am happy to report that we are moving ahead rapidly, and we are meeting our key milestones on schedule.

I think that it is appropriate at this time to comment on what appears to be a general misconception about the overall purposes of the Apollo Program. Many people believe that a landing on the moon, ahead of the Soviets, is the paramount objective. This is not so. The principal goal is to make the United States first in space by the end of this decade, and to make this pre-eminence unmistakably clear to the world.

To achieve this objective requires much more than scientific research and technological development, however. It requires a hard, clearly-defined goal. The Apollo Program has such a goal. I've often considered that we are fortunate that the moon exists, because it gives us a hard but achievable goal. It would be much more difficult - in fact, almost impossible -- to maintain a firm schedule or a Nation's determination to "fly out into space a couple of hundred thousand miles, stay there a day or so, and then return." The existence of a firm goal, difficult but possible -- to land two men on the moon and return them safely to earth - provides a goal big enough to unify and inspire a Nation.

Why, however, is it so vital that the United States be pre-eminent in space? There are many reasons that can be cited. For example, it is imperative, in the Cold War arena, that the United States be first for reasons of national security, and for our position of world leadership.

Additional reasons include the benefits of scientific discovery; the stimulation of economic and social progress; technological advancement; and what has been called "the compelling urge of man to explore and to discover."

Let us look briefly at some of these motivations. First, consider the national security, or peace-keeping, aspects.

Although our space program is a peaceful endeavor, it cannot help but have a profound effect on our future military position. Although there is no military space force in being in any nation's arsenal, it would be disastrous for the United States to lack the basic understanding, the basic technology, and the basic engineering which would be required if an aggressor should choose to make space a battlefield.

Today, in the manned space flight programs we are speeding development of very powerful launch vehicles, highly sophisticated spacecraft, complex test and launch facilities, better electronic devices, improved materials and more accurate guidance systems, as well as gaining valuable data on how well man can function in space and for how long. In addition, the ability to maneuver and to rendezvous and dock with another object in space is of tremendous importance, not only to our goals in the Apollo Program, but to the Nation's overall goals in space.

All of these elements and capabilities, constitute a national resource of enduring value which will provide the nation with the freedom of operation in space necessary to carry out the wide variety of missions that may be required by the national interest. Such freedom of operation is essential to the national security

and the preservation of peace in space. Indeed, President Johnson has said that "the avenues of space offer man's best hope for bringing nearer the day of peace on earth."

In the international arena, our space programs -- and Manned Space Flight in particular -- may be considered as a measure of our ability to compete with a formidable rival, and as a criterion of our ability to maintain technological eminence.

The influence of our scientific and technological progress and prowess is and has been one of the deciding factors in keeping the Cold War peace over the past 20 years. Our space effort is a basic factor in increasing our scientific and technological power. Should we fall behind in the area of space technology, we would jeopardize our national interests, on earth as well as in space.

There can be no question but that the Soviet Union considers space as a vital element in the Cold War spectrum of conflict. In December, 1957, after the launching of Sputnik, former Soviet Premier Khrushchev stated that, "The launching of artificial earth satellites is a kind of culmination of the competition between socialist and capitalist countries. And socialism has won it." The dramatic recent progress in our space programs - and particularly the successful Gemini flights --

have made many people throughout the world conclude that Khrushchev was premature in declaring that "socialism has won it."

In our space programs the world sees a Nation of great scientific and technological capability. And I mean, quite literally, "sees", since NASA conducts its operations before the eyes of hundreds of millions of people all over the world. These people do not have to take the word of a scientist or an engineer or a politician. They can say: "I saw it myself!"

We are thus using our scientific and technological power to work toward a peaceful and better world, and this power is vividly exemplified by our achievements in space.

Turning to science, the implications of the space program are immense. NASA programs are already yielding knowledge of significant scientific value through our unmanned scientific satellites and the many scientific, technological, and biological experiments performed during the manned flights.

Further in the future, our explorations into space will answer vital questions about the origins, early history and evolution of the solar system and the cosmos as a whole; it will enable us to investigate for life on other planets; and potentially it will give us an understanding of the origin of life itself.

As President Johnson has said, "We expect to explore the Moon, not just visit it or photograph it. We plan to explore and chart planets as well. We shall expand our Earth laboratories into space laboratories and extend our national strength into the space dimension."

It would be presumptuous of me to forecast the eventual meaning of man's greater knowledge of the universe. A little closer to earth, however, the impact of space activities has already begun to show up in many areas affecting our daily lives.

For example, let us consider the economic benefits of space at a time when increasing emphasis is being placed on programs to better our country through elimination of poverty, and greater attention to human welfare.

In this connection, we should recall that the space program is being carried out on earth, in almost every portion of the country, and reaches into almost every corner of American life. It involves not only science and technology, but also almost every form of ordinary business and professional activity. In fact, only about 15 percent of the people working on the Apollo Program are scientists and engineers.

The space program has created hundreds of thousands of jobs. It has created and is helping to create new

basic industries for our economy. The number of private companies and space research organizations participating in the space program has grown to more than 20,000. Thousands of companies in turn are selling goods and services to the space-program companies, and untold thousands more are selling to people whose pay-checks come from these companies.

From the foregoing, the direct economic impact of the space program is quite obvious. Not so obvious, but nonetheless real, are the more fundamental contributions of the program to the economic growth of the Nation and its various regional components.

Economic growth is associated with three things: first, capital deepening, that is, an increase in the ratio of capital to labor; secondly, the existence of social attitudes and behavior that are conducive to industrial, scientific and intellectual ferment and finally, technological innovation. The space programs have and will continue to benefically affect thsese three interrelated aspects of economic growth.

The process of economic growth necessitates the rapid development, acceptance, and implementation of new technologies. In an economically developed nation such as ours, this is accomplished by invention and innovation. Thus, the Nation's efforts to push into the frontiers of

space have accelerated materially a fundamental aspect of economic growth -- the generation of new technology.

From this new technology spring new products as well as cost-saving techniques for the production of existing products. These developments in turn set the stage for capital deepening. Further as the program contributes to the promotion of educational and intellectual ferment, a strong new force is added for the maintenance and development of social attitudes and behavior so essential to economic growth. The latter possesses particular significance for relatively underdeveloped regions of the Nation.

It is thus apparent that the space program is not in conflict with efforts to end poverty and improve human welfare. On the contrary, it contributes to the fundamental solution of these problems by bringing about giant steps in economic and technological development, giving people the opportunity to help themselves through new economic activities.

Now, what of the future in space?

As I mentioned earlier, we are building up tremendous capabilities in our present Manned Space Flight programs. For example, it is important to note that the spacecraft and launch vehicles being developed in the Apollo Program are good for flights in Earth orbits of various kinds,

and in orbits about the Moon, as well as for landings on the Moon.

By using our capabilities effectively and imaginatively, we will be able to carry out a wide variety of missions of significant scientific value and of direct benefit to mankind here on earth. Let me emphasize, however, that the first task to be performed, before these benefits can be provided, is to learn to operate in space. Before we can deliver people and equipment to the place where this work is to be done, we must investigate the conditions and the problems associated with operations in the weightless, vacuum environment.

Columbus' voyage to America captured the imaginations of men of his time. Yet, it was not until many ships had traveled regularly from Europe to America that man really began to explore and exploit this continent, and the new continent began to make its real contributions to the civilized world.

In like manner, I think that men will have to live and work in the space environment for some time before they can begin to fully exploit this new resource that is becoming available. In the period immediately following the accomplishment of the Apollo program, a most important task will be to gain this experience and to develop

advanced operational techniques for use in future programs.

Now, let us consider a few of the potential applications of our space resources.

The amount of weather information obtained from space can be increased to the stage where we could program the earth's entire atmosphere on a computer, and make accurate long-range weather forecasts for the entire world. Advanced communications stations could provide television and radio broadcasting to the entire world, and to meet the ever-increasing requirements for telephone and telegraph channels between continents. In addition, the use of satellites as control towers in space can help to handle the continually increasing speed and volume of traffic on the world's airways, provide all weather navigation service for ships at sea, and support for a worldwide air-sea rescue service. Operation, maintenance and repair of these various space stations can be carried out by human technicians.

An entire group of potential applications is based on the use of manned observations and actions in space to make fuller use of the resources of the earth, considered on a planet-wide basis.

One such resource is raw materials. From space one can measure the intensity of visible, infrared

and ultraviolet light reflected from the surface. This can tell a great deal about the availability of minerals, and petroleum reserves, particularly in the more remote regions that have not been explored in detail. The use of photography and other forms of remote sensing by human operators in space can also supply agriculture with the information it needs on the status of crops and forests on a continental or world-wide basis, so that the most modern techniques can be applied to cope with the needs of an exploding world population.

Information of value can also be obtained by observation of the oceans for marine life and mineral resources, as well as observation of land masses for current information on the status of rivers and lakes. The significance of such information for flood control and in the overall management of water resources is obvious.

In addition, exploration of the universe can be aided by placing large observatories in Earth orbit. This will enable astronomers to see the sky clearly, undistorted by the Earth's atmosphere. Scientists and explorers can also survey and study the Moon, to learn what resources are there and what can be learned about the origins of the Moon and its sister body, the Earth.

Looking a little further into the future, one can foresee many additional dramatic and important developments in space exploration. These developments follow a logical sequence that leads from the present program to larger permanent manned space stations, the establishment of permanent bases on the moon, the launching of unmanned probes to every part of the solar system - and manned planetary expeditions as well!

Thus, it is clear that the challenges and opportunities to be found in space are virtually limitless. These challenges and opportunities will not be limited to space alone. The progress of America has been shaped in a vast open continent. One need only glance at the historical interpretations attributing our rise as a great nation to the influence of the frontier to find a striking parallel in the present era. The Space Frontier is already providing an unprecedented peacetime stimulus to science, to industry and to education. The very presence of this limitless frontier is a guarantee that man will never find himself without large motivations leading to great endeavors.

Space exploration in its broadest meaning and in all of its ramifications has become a powerful force, exerting great influence upon our present and future -- socially, economically, politically, and even morally.

It expands our horizons even as it shrinks the world. It is a complex combination of many related elements. It is a broad-based scientific and technological endeavor. It is a creator of new technologies, new techniques, and new methods of management. It has great significance for our national security. It is a stimulus for our economic and national growth. It is a catalyst to the achievement of the goals of our society. And it provides us with the dimensions of a great challenge -- to explore space for the benefit of all mankind.

What does all this mean to you and me? It means that we must all adjust ourselves to this accelerating rate of change and growth in which the world is engaged. We must expect to work, to contribute, to grow, to mature - to meet the challenges if America is to continue to lead the world.

Although our space efforts and activities have created a need for more scientifically and technically trained people, this is not the whole picture. Many of the demands of the Space Age will be non-scientific and non-technical in nature. They will increasingly affect and involve all of you. As voters and citizens, and in countless professions and jobs, you will be called upon to evaluate and judge the events in the

emerging new world - a world of space - and to understand and interpret the significance and the implications of the complex and inter-locking events of this world. The demands upon you - as informed citizens - will be for open and understanding minds, imagination, alertness, confidence, faith, and for original thinking.

Truly, the potentials which the future holds for us are great beyond all expectation. Through the wonders of science and technology, the "impossible" of today will be the commonplace of tomorrow. The "unexpected" must be expected. If we can marshal our efforts to conquer the cosmos, then surely we can unite ourselves to the solving of other problems. We can rebuild our cities, revolutionize transportation and communications, conquer disease and eliminate hunger, harvest the riches of the oceans, solve our social problems, and, hopefully, bring about a lasting world peace based upon a true and effective Order of World Law.

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